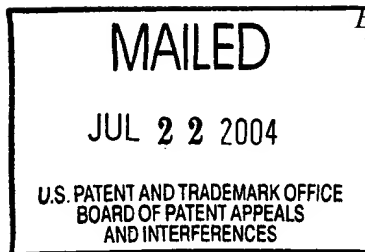


The opinion in support of the decision being entered today was *not* written for publication and is *not* binding precedent of the Board.

Paper No. 25

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES



Ex parte CHRISTOPHER A. HOFMEISTER

Appeal No. 2004-1398
Application 09/163,844

ON BRIEF

Before KIMLIN, WARREN and PAWLIKOWSKI, *Administrative Patent Judges*.

WARREN, *Administrative Patent Judge*.

Decision on Appeal

This is an appeal under 35 U.S.C. § 134 from the decision of the examiner finally rejecting claims 1 through 5, 8 through 16, 26, 28 and 29. Also of record are claims 6, 7 and 19 through 23 which have been allowed by the examiner, and claims 17, 18, 24, 25 and 27 which have been objected to by the examiner as being allowable but dependent on a rejected base claim.

Claims 1, 26, 5, 8 and 29 are illustrative of the claims on appeal:

1. A method for transporting a substrate into and out of a substrate holding area on a substrate processing apparatus comprising the steps of:

providing the substrate processing apparatus with a transport arm connected to a drive section with two drive shafts;

providing the substrate on an end effector of the transport arm, the end effector being rotatably mounted to a wrist of the transport arm; and

rotating the two drive shafts to effect rotation of the transport arm about an axis of rotation at a shoulder of the transport arm for rotating the wrist about the axis of rotation, and

to effect extension of the transport arm for radially displacing the wrist of the transport arm relative to the axis of rotation at the shoulder of the transport arm,

wherein the extension of the transport arm to radially displace the wrist causes rotation of the end effector about the wrist to rotate the substrate about the axis of rotation at the shoulder of the transport arm in concert with rotation of the wrist about the axis of rotation at the shoulder of the transport arm so that the substrate is moved along one of a number of generally parallel axes of translation straddling the drive section.

26. A method as in Claim 1, wherein the substrate processing apparatus comprises at least three of the substrate holding areas located side by side to each other, the transport arm transporting substrates into and out of each of the three substrate holding areas, and wherein the axis of rotation at the shoulder of the transport arm stays in one location relative to the three substrate holding areas when the transport arm transports substrates into and out of each of the three substrate holding areas.

5. A method for transporting a substrate into and out of a substrate holding area comprising the steps of:

providing the substrate on an end effector of a transport arm;

rotating the transport arm as a unit about an axis of rotation; and

moving the end effector of the transport arm to radially displace the end effector relative to the axis of rotation, the end effector being moved from an initial position to a final position, the initial and final positions of the end effector being connected by an axis of translation of the end effector;

wherein the radial displacement of the end effector complements the rotation of the transport arm about the axis of rotation to result in the substrate being substantially rectilinearly translated along the axis of translation to and from the substrate holding area, the axis of translation being one of two generally parallel axes of translation on opposite sides of the drive section.

8. A substrate transport apparatus comprising:

a drive section; and

a robot transport arm mounted to the drive section, the robot transport arm having a wrist and an end effector to hold a substrate thereon, the end effector being rotatably mounted to the wrist to rotate about the wrist, rotation of the end effector about the wrist being slaved to the robot transport arm;

wherein the robot transport arm is adapted to transport substrates into and out of three general side by side orientated substrate holding areas with the drive section being located in only one location relative to the three holding areas, and wherein the three side

by side substrate holding areas are generally aligned with each other and disposed along one side of the drive section.

29. A method for transporting a substrate into and out of a substrate holding area on a substrate processing apparatus comprising the steps of:

providing the substrate processing apparatus with a transport arm connected to a drive section having two drive shafts;

providing the substrate on an end effector of the transport arm, the end effector being rotatably mounted to a wrist of the transport arm; and

rotating the two drive shafts to effect rotation of the transport arm about an axis of rotation at a shoulder of the transport arm for rotating the wrist about the axis of rotation, and

to effect extension of the transport arm to radially displace the wrist of the transport arm relative to the axis of rotation at the shoulder of the transport arm,

wherein the extension of the transport arm when the second drive shaft is rotated effects rotation of the end effector about the wrist, the rotation of the transport arm about the axis of rotation at the shoulder, the extension of the transport arm to radially displace the wrist relative to the axis of rotation at the shoulder and the rotation of the end effector about the wrist being in concert so that the substrate is moved into and out of the substrate holding area along an axis of translation from a number of generally parallel axes of translation straddling the axis of rotation at the shoulder.

The appealed claims, as represented by the above claims, are drawn to methods for transporting a substrate into and out of a substrate holding area ("holding area") of a substrate processing apparatus as well as such an apparatus, wherein the apparatus has a transport arm ("arm") that comprises (1) a drive section, which can have two drive shafts, that rotates the arm about an axis of rotation at the shoulder and causes rotation of the wrist about said axis of rotation; and (2) an end effector, which holds the substrate, that rotates about the wrist, slaved to the arm. The extension of the arm radially displaces the wrist, causing rotation of the end effector, and thus the substrate, about the axis of rotation at the shoulder of the arm in concert with rotation of the wrist about the axis of rotation at the shoulder, moving the end effector, and thus the substrate, from an initial position to a final position, the positions being connected by an axis of translation.

With the specified capabilities, the arm, in the claimed methods, moves the end effector holding the substrate into and out of a holding area along one of a number of generally parallel axes of translation straddling the drive section, as in the methods of claims 1 and 29, which

movement is specified in the method encompassed by claim 5 as substantially rectilinearly translating the substrate along the axis of translation which is one of two generally parallel axes of translation on opposite sides of the drive section. In the method of claim 26, dependent on claim 1, and as specified in the apparatus encompassed by independent claim 8, there can be three holding areas located side by side or aligned with each other along one side of the drive, and the axis of rotation at the shoulder of the arm remains in one location relative to the holding areas.

According to appellant, in the claimed invention, the arm moves substrates into and out of a holding area without having to position the arm in front of each holding area, "and without an additional independent drive system dedicated to independently rotate the" end effector "about the wrist" (specification, pages 17-18).

The references relied on by the examiner are:

Ohta et al. (Ohta)	4,781,512	Nov. 1, 1988
Fukasawa et al. (Fukasawa)	5,611,655	Mar. 18, 1997
Bacchi et al. (Bacchi)	5,741,113	Apr. 21, 1998

The examiner has advanced the following grounds of rejection on appeal:

claim 5 stands rejected under 35 U.S.C. § 102(b) as anticipated by Fukasawa (answer, pages 3-4 and 5);

claims 1 through 4, 26 and 29 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Fukasawa in view of Bacchi (answer, pages 4 and 5-6);

claims 8 through 16 and 28 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Bacchi in view of Ohta (answer, pages 4 and 6); and

claims 8 through 16 and 28 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Ohta in view of Bacchi (answer, pages 4-5 and 6).

Appellant groups the appealed claims into six groups (brief, page 3; supplemental brief, page 3)¹ and submits separate argument with respect to each group. Thus, we decide this appeal based on appealed claims 5, 1, 26, 29, 8 and 28 as representative of the respective groups.

37 CFR § 1.192(c)(7) (2001).

¹ Appellant filed the brief on December 17, 2001 (Paper No. 15), and the supplemental brief on August 14, 2002 (Paper No. 17).

We affirm the ground of rejection of appealed claims 1 through 4, 26 and 29, and we reverse all other grounds of rejection. Accordingly, the examiner's decision is affirmed-in-part.

Rather than reiterate the respective positions advanced by the examiner and appellant, we refer to the examiner's answer and to appellant's brief, supplemental brief and reply brief for a complete exposition thereof.

Opinion

We first consider the ground of rejection of appealed claim 5 under § 102(b) as anticipated by Fukasawa. It is well settled that in making out a *prima facie* case of anticipation, each and every element of the claimed invention, arranged as required by the claim, must be found in a single prior art reference, either expressly or under the principles of inherency. *See generally, In re Robertson*, 169 F.3d 743, 745, 49 USPQ2d 1949, 1950-51 (Fed. Cir. 1999); *In re Schreiber*, 128 F.3d 1473, 1477, 44 USPQ2d 1429, 1431 (Fed. Cir. 1997); *Lindemann Maschinenfabrik v. American Hoist and Derrick*, 730 F.2d 1452, 1458, 221 USPQ 481, 485 (Fed. Cir. 1984). Whether the teachings and inferences that one skilled in this art would have found in the disclosure of an applied reference would have placed this person in possession of the claimed invention, taking into account this person's own knowledge of the particular art, is a question of fact. *See generally, In re Graves*, 69 F.3d 1147, 1152, 36 USPQ2d 1697, 1701 (Fed. Cir. 1995), and cases cited therein (a reference anticipates the claimed method if the step that is not disclosed therein "is within the knowledge of a skilled artisan."); *In re Preda*, 401 F.2d 825, 826, 159 USPQ 342, 344 (CCPA 1968) ("[I]n considering the disclosure of a reference, it is proper to take into account not only specific teachings of the reference but also the inferences which one skilled in the art would reasonably be expected to draw therefrom."). It is also well settled that in order to establish that a claim element is inherent in the single prior art reference, it must be established that such limitation is necessarily present in the description in the reference and that it would be recognized as such by one of ordinary skill in the art, as "[t]he mere fact that a certain thing may result from a given set of circumstances is not sufficient. [Citations omitted.]" *In re Oelrich*, 666 F.2d 578, 581, 212 USPQ 323, 326 (CCPA 1981); *see also Transclean Corp. v. Bridgwood Serv., Inc.*, 290 F.3d 1364, 1372-73, 62 USPQ2d 1865, 1870-71 (Fed. Cir. 2002); *MEHL/Biophile Int'l Corp. v. Milgram*, 192 F.3d 1362, 1365, 52 USPQ2d

1303, 1305-06 (Fed. Cir. 1999); *Robertson*, 169 F.3d at 745, 49 USPQ2d at 1950-51; *Continental Can Co. USA v. Monsanto Co.*, 948 F.2d 1264, 1268-69, 20 USPQ2d 1746, 1749-50 (Fed. Cir. 1991); *In re King*, 801 F.2d 1324, 1326, 231 USPQ 136, 138 (Fed. Cir. 1986).

In the answer (pages 3-4), the examiner finds that in Fukasawa **FIGs. 1 and 2**, the axis of rotation of arm **5** is located between cassette chambers **3a** and **3b**, which are on one side of convey chamber **2**, and between vacuum processing chambers **4a** and **4b**, which are on the opposite side of convey chamber **2** (*see, e.g.*, col. 5, lines 3-17). The examiner further finds that “[t]he only feature [of appealed claim 5] not shown is the exact transfer path of the wafer into and out of each of” the cassette chambers and the vacuum processing chambers (answer, page 4). In this respect, the examiner contends that “[d]ue to the parallel side walls of each of” the cassette chambers and the vacuum processing chambers, “it is *inherent* that the wafers are moved straight into and out of each of” the cassette chambers and the vacuum processing chambers “to avoid contact with the parallel sides of” the cassette chambers and the vacuum chambers (*id.*; emphasis supplied).

Appellant submits in the brief that Fukasawa does not anticipate appealed claim 5 which calls for the initial and final position of the end effector being connected by an axis of translation which is one of two generally parallel axes of translation of the end effector; wherein

- radial displacement of the end effector complements rotation of the transport arm as a unit to result in the substrate being translated along the axis of translation.

[Page 4.]

In these respects, appellant points out that “[a]s shown in Fig. 4, each arm 51, 52, 53 of the multi-joint arm 5 . . . is pivoted by an independent motor,” citing col. 6, lines 40-43 and 49-51 (brief, page 4; *see also* page 6). Appellant contends that the reference “makes no mention whatsoever of the path followed by the upper convey arm 53, and substrate into and out of the substrate holding areas” 3a, 3b, 4a and 4b; does not disclose “that the end effector is moved from an initial position to a final position along an axis of translation,” and does not disclose “that the substrate is moved into and out of the substrate holding area along the axis of translation connecting the initial and final positions of the end effector” (*id.*, pages 4-5).

With respect to the examiner's contention of inherency, appellant submits that "[i]n Fukasawa, it is not necessary that the wafers be rectilinearly translated into or out of the cassettes 3a, 3b or processing chambers 4a, 4b," and explains that "up to the point where the maximum diameter of the wafer is inside the cassette, the wafer may be moved into" as well as removed from the cassette at least in part along a curvilinear path (*id.*, page 5). Appellant further points out that "[o]utside the cassette, the wafer can be moved along any number of paths as can be provided with the three independently pivotable convey arms (51, 52, 53) . . . which has a high degree of freedom," citing the disclosure in col. 10, lines 41-43, "that the convey path for a wafer can be freely selected" (*id.*).

Appellant further submits that appealed claim 5 additionally requires that radial displacement of the end effector complements rotation of the transport arm as a unit to result in the substrate being translated along the axis of translation. [*Id.*, page 6.]

Appellant argues that Fukasawa does not disclose "that the radial displacement of the end effector (convey arm 53) relative to the axis of rotation of the transport arm has any particular relation to (i.e. complement) the rotation of the transport arm as a unit about the axis of rotation," again pointing out that the movement of each of the convey arms "can be freely selected within the stroke range of each arm 51-53 (*id.*, pages 6-7).

In response, the examiner "agrees with appellant that Fukasawa discloses that the convey path for a wafer can be freely selected," but contends that "[w]hile the wafer path . . . could be curvilinear as alleged by appellant[,] [c]urvilinear paths are" more complex to program, arguing that since "[s]traight line paths . . . are common and easier to program it is inherent that such are used in Fukasawa" (answer, page 5).²

In the reply brief, appellant submits that the cassette and vacuum processing chambers "appear to have parallel side walls does not anticipate the features recited in claim 5" and "does

² The examiner relies on evidence in *Bacchi* to support this ground of rejection but has not included this reference in the statement of the ground of rejection (*see* answer, pages 3-4 and 5). Accordingly, we have not considered *Bacchi* as here applied by the examiner. *Cf. In re Hoch*, 428 F.2d 1341, 1342 n.3, 166 USPQ 406, 407 n.3 (CCPA 1970); *Ex parte Raske*, 28 USPQ2d 1304, 1304-05 (Bd. Pat. App. & Int. 1993).

not make it necessary that the arm 5 move the wafer between initial and final positions in a straight line, much less a line which is one of two generally parallel axes of translation” (pages 1-2). In this respect, appellant argues “that in a method for transporting a substrate into and out of a holding area, it is not possible for both initial and final positions to be within the same holding area” (*id.*, page 2). Appellant points out that the wafer must be transported into and out of a holding area, and Fukasawa discloses that the convey path is freely selectable (*id.*). Appellant submits that the examiner’s position that “straight convey paths are common” is not relevant “because straight paths are common does not mean that they are necessary,” and Fukasawa does not disclose the arm movement which translates the substrate along the axis of rotation (*id.*).

We agree with appellant’s position as we find as a matter of fact that the examiner has not demonstrated that Fukasawa discloses each and every element of the claimed method encompassed by appealed claim 5, arranged as required by the claim, either expressly or under the principles of inherency, and thus has not established a *prima facie* case of anticipation under § 102(b). When considered in light of the written description in the specification, as interpreted by one of ordinary skill in this art, *see, e.g., In re Morris*, 127 F.3d 1048, 1054-55, 44 USPQ2d 1023, 1027-28 (Fed. Cir. 1997), the plain language of claim 5 specifies a method for transporting a substrate into and out of a holding area by specifying both the functional capability of the arm and the steps of moving the arm in particular manner.

We find that, as pointed out by appellant, Fukasawa discloses a multi-joint arm 5 designed to have freedom of movement in conveying substrates between cassettes and vacuum processing chambers, which includes placing the substrate on a positioning mechanism 7 (e.g., col. 2, lines 24-29; col. 3, lines 12-18; col. 5, lines 9-17 and 50-54; col. 6, lines 39-55; col. 6, line 65; to col. 7, line 9; col. 9, lines 22-65; col. 10, lines 7-24 and 36-65; Fukasawa **FIGs. 1 and 2**; and Fukasawa **FIGs. 13a and 25**, and cols. 17 and 19-20). Indeed, Fukasawa discloses that the freedom of operation of the arm, and thus, freedom in the position of the arm and the convey paths translated thereby, is intended to be high in order to achieve a high degree of freedom in the design of the apparatus (col. 10, lines 36-50). Thus, while this description of the method and apparatus disclosed by Fukasawa can reasonably be said to be broad enough to encompass the claimed method encompassed by appealed claim 5 as a matter of fact, there is no express

disclosure of or any direction to the claimed method *per se* in the reference. *See generally, In re Arkley*, 455 F.2d 586, 587-88, 172 USPQ 524, 526 (CCPA 1972) (“[F]or the instant rejection under 35 U.S.C. 102(e) to have been proper, the . . . reference must clearly and unequivocally disclose the claimed compound or direct those skilled in the art to the compound without *any* need for picking, choosing, and combining various disclosures not directly related to each other by the teachings of the cited reference. Such picking and choosing may be entirely proper in the making of a 103, obviousness rejection, where the applicant must be afforded an opportunity to rebut with objective evidence any inference of obviousness which may arise from the *similarity* of the subject matter which he claims to the prior art, but it has no place in the making of a 102, anticipation rejection.”).

The examiner recognizes that such is the case by alleging in the statement of the rejection that the claimed method is *inherent* in the reference because the parallel side walls of the cassette chambers and the vacuum chambers require that the wafers must be moved straight into and out of the same. However, in response to appellant’s arguments with respect thereto in the brief, the examiner did not defend this position, indeed agreeing with appellant that the convey path into and out of the cassettes and vacuum processing chambers could include a curvilinear segment. Thus, in his response, the examiner takes the further position that because straight convey paths are common in the art and easy to program, one of ordinary skill in the art would inherently use such paths with the apparatus of Fukasawa.

While arms that are linearly reciprocated and rotatable are known, as acknowledged by Fukasawa (col. 1, lines 50-67), we agree with appellant that there is no evidence in the record that one of ordinary skill in this art armed with such knowledge would *necessarily*, and thus, *inherently* control arm 5 disclosed by Fukasawa to perform at least the steps comprising the claimed method encompassed by appealed claim 5. *See, e.g., Robertson*, 169 F.3d at 745, 49 USPQ2d at 1950-51; *King*, 801 F.2d at 1326, 231 USPQ at 138; *cf. Graves*, 69 F.3d at 1152, 36 USPQ2d at 1701.

Accordingly, we reverse the ground of rejection of appealed claim 5 under § 102(b) as anticipated by Fukasawa.

We next consider the ground of rejection of appealed claims 1, 26 and 29 under § 103(a) as being unpatentable over the combined teachings of Fukasawa and Bacchi. In order to establish a *prima facie* case of obviousness, the examiner must show that some objective teaching, suggestion or motivation in the applied prior art taken as a whole and/or knowledge generally available to one of ordinary skill in this art would have led that person to the claimed invention as a whole, including each and every limitation of the claims arranged as required by the claims, without recourse to the teachings in appellant's disclosure. *See generally, In re Rouffet*, 149 F.3d 1350, 1358, 47 USPQ2d 1453, 1458 (Fed. Cir. 1998); *Pro-Mold and Tool Co. v. Great Lakes Plastics Inc.*, 75 F.3d 1568, 1573, 37 USPQ2d 1626, 1629-30 (Fed. Cir. 1996); *In re Oetiker*, 977 F.2d 1443, 1445, 24 USPQ2d 1443, 1444 (Fed. Cir. 1992); *In re Fritch*, 972 F.2d 1260, 1265-66, 23 USPQ2d 1780, 1783-84 (Fed. Cir. 1992); *In re Laskowski*, 871 F.2d 115, 10 USPQ2d 1397 (Fed. Cir. 1989); *In re Fine*, 837 F.2d 1071, 1074-76, 5 USPQ2d 1596, 1598-1600 (Fed. Cir. 1988); *In re Dow Chem. Co.*, 837 F.2d 469, 473, 5 USPQ2d 1529, 1531-32 (Fed. Cir. 1988). The requirement for objective factual underpinnings for a rejection under § 103(a) extends to the determination of whether the references can be combined. *See In re Lee*, 277 F.3d 1338, 1343, 61 USPQ2d 1430, 1433-34 (Fed. Cir. 2002), and cases cited therein.

The examiner submits that “[i]t would have been an obvious substitution of equivalents to substitute an arm utilizing two drives as taught by Bacchi for the arm in Fukasawa” (answer, page 4).

Appellant points out that appealed claim 1 requires two drive shafts to effect certain claimed movements of the arm and its slaved wrist relative to the axis of rotation at the shoulder of the arm, including moving the substrate along one of a number of generally parallel axes of translation straddling the drive section, and thus, the claimed movement of the substrate along a straight line, which features are not disclosed or suggested by Fukasawa (brief, pages 7-8, and 9-10). Appellant points out that each arm 51, 52 and 53 of the multi-joint arm 5 of Fukasawa has an independent motor, and movement of the arm requires all three drive shafts in a manner such that arm 5 “cannot and does not perform the features called for in claim 1 with only two arms, and more to the point by rotating only two drive shafts,” and that the reference “makes no

mention as to how the convey arms 51-53 are moved to convey wafer W along any path" (*id.*, pages 8-9 and 10).

Appellant describes the "three-link robot arm mechanism 10" of Bacchi and the movement thereof by two drive shafts (*id.*, page 11). Appellant characterizes arm 10 of Bacchi as having "two degrees of freedom" in contrast with arm 5 of Fukasawa which has "three independent degrees of freedom," and argues that the prior art arms are not equivalents (*id.*; see also reply brief, page 4). Appellant further submits that

as seen in Fig. 6a, Bacchi discloses that arm mechanism 10 removes wafers from two cassettes 168l, 168r along corresponding straight line transport paths. The transport paths corresponding to cassettes 168l, 168r appear to be parallel but are not straddling the drive section of the arm as otherwise called for in claim 1. In Bacchi, the drive section (i.e., drive motors 50, 52) is located at the shoulder 16 of the arm mechanism (see Fig. 2). As disclosed in Fig. 6a, the straight line transport path to cassette 168l in Bacchi extends through the shoulder. Hence, the transport paths in Bacchi do not straddle the drive section of the arm. Nowhere does Bacchi disclose or suggest that arm 10 moves the wafer into and out of the cassettes along one of a number of parallel axes straddling the drive section as called for in claim 1. [Brief, pages 11-12.]

Appellant thus argues that in view of the differences in degrees of freedom of the arms and the location of the storage areas relative to the drive section, it would not have been obvious to combine the references (*id.*, page 12). Appellant further contends, *arguendo*, that even if properly combinable, the claimed invention encompassed by appealed claim 1 would not have been obvious over the applied prior art because Fukasawa has the wafer chambers "offset on both sides of the arm drive section" but does not mention convey paths, and Bacchi "moves wafers along two straight line transport paths, to cassettes 168l, 168r, one of which extends through the centerline of the arm drive section" (*id.*). Thus, appellant argues that

nothing in Fukasawa and Bacchi make it obvious to one skilled in the art to rotate the drive shafts to rotate and extend the arm such that the substrate is moved (into and out of the substrate holding areas) along one of a number of parallel axes straddling the drive section as otherwise called for in claim 1. [*Id.*, pages 12-13.]

The examiner responds that the arm in both references "rotates about a shoulder, elbow and wrist," with the difference being "that the wrist in Fukasawa is independently driven and that in Bacchi is slaved to the elbow" (answer, pages 5-6). The examiner contends that

[n]onetheless, Bacchi's arm moves wafers along straight lines into and out of cassettes. Note fig 6A in Bacchi wherein on [sic, one] cassette lies along the shoulder axis and one axis is offset from the shoulder. Thus, the arm in Bacchi would be mounted in Fukasawa in the same place as Fukasawa's arm, i.e., with the shoulder axis offset from the axes of the process chambers and cassette. See Fukasawa, figure 2.
[Id.]

The dispositive issue is whether the disclosure in Bacchi with respect to arm 10 as shown, e.g., in Bacchi FIGs. 2, 3 and 6A (e.g., cols. 3-8; see also cols. 2-3), would have reasonably suggested to one of ordinary skill in this art that arm 10 can be used in methods of conveying wafers into and out of cassettes along generally parallel axes of translation which are offset from, that is, straddle, the axis of rotation at the drive located at the shoulder of the arm.³ In this respect, the appellant and the examiner appear to find that Bacchi FIG. 6A, as described at col. 7, line 21, to col. 8, line 52, shows parallel axes of translation that do not straddle the drive section because, as appellant argues, in this figure, the axis of translation of cassette 168, extends through the shoulder of arm 10.

We find that Bacchi would have disclosed to one of ordinary skill in this art that "FIG. 6A is a diagram showing spatial relationships and parameters that are used to derive the control signals provided by . . . the motor controller for the embodiments of the three-link robot arm mechanism" (col. 3, lines 59-63). Bacchi would have disclosed with respect to moving wafer 170, from cassette 168, that

FIG. 6A is a diagram that specifies a local coordinate axis frame whose axes are defined by the orientation of a . . . wafer cassette 168, and its location relative to shoulder axis 16. With reference to FIG. 6A, the following description sets forth the mathematical expressions from which are derived the command signals controller 54 uses to retrieve from cassette 168, a wafer 170, along a vector perpendicular to the opening of cassette 168.

....

To retrieve wafer 170, from cassette 168, along a straight line path, the displacement along the X-axis equals X_0 , which is a constant. . . . Because upper arm

³ It is well settled that a reference stands for all of the specific teachings thereof as well as the inferences one of ordinary skill in this art would have reasonably been expected to draw therefrom, see *Fritch*, 972 F.2d at 1264-65, 23 USPQ2d at 1782-83; *Preda*, 401 F.2d at 826, 159 USPQ at 344, presuming skill on the part of this person. *In re Sovish*, 769 F.2d 738, 743, 226 USPQ 771, 774 (Fed. Cir. 1985).

14 and forearm 22 are of the same length (r), θ_1 tracks the angle θ_s of motor 52, and hand 30 moves in a straight line. . . . Equation (3) expresses the constraint that sets out the relationship between the angles θ_s and θ_E of motors 52 and 50 operating to move equal angular distances to achieve straight line movement of hand 30.

Skilled persons can implement constraint equation (3) by means of a servomechanism controller in any one of a number of ways. . . .

To achieve angular displacement of hand 30 about shoulder axis 16, controller 54 causes motors 50 and 52 to rotate in the same direction through the desired angular displacement of hand 30 to reach the desired destination. The linear extension of hand 30 does not change during this move. Skilled persons will appreciate that complicated concurrent linear and angular displacement move profiles of hand 30 could be accomplished by programming controller 54 to operate motors 50 and 52 through different angular displacements. [Col. 7, line 19, to col. 8, line 43.]

Bacchi would have further disclosed with respect to moving wafer 170, from cassette 168, that

FIG. 6A shows a second wafer cassette 168, positioned so that the center 172, of a stored wafer 170, is coincident to Y_0 . [Col. 8, lines 43-45.]

Bacchi would have still further disclosed with respect to **FIG. 6A** that

[t]he parallel arrangement of the openings of cassettes 168, and 168, demonstrates that the above expressions can be used to retrieve wafers stored in cassettes not positioned a radial distance from the shoulder axis 16. Such nonradial placement is not implemented in the prior art references described above. Robot arm mechanism 10 is not restricted to radial placement, but can accommodate any combination of distances within its reach. [Col. 8, lines 45-52.]

We determine as a matter of fact that in this disclosure, Bacchi does *not* restrict the movement of arm 10 and the alignment of cassettes 168, and 168, to that shown in **FIG. 6A**. Thus, we find that one of ordinary skill in this art would have been taught by this clear disclosure that arm 10 can move wafers along generally parallel axes of translation which are radial to or offset from either or both sides of, that is, *straddle*, the drive section or axis of rotation at shoulder 16 of arm 10. Indeed, this disclosure coupled with the disclosure at col. 4, line 36, to col. 6, line 14, would have taught one of ordinary skill in the art that arm 10 has the range of movement necessary to perform such a method of moving wafers.

We note again here the disclosure of Fukasawa that appellant acknowledges as well as our findings as to the teachings of this reference as we discuss above, including appellant's

recognition that Fukasawa has the wafer chambers “offset on both sides of the arm drive section” even though the reference does not mention convey paths (*see above* pp. 10-11).

Based on the substantial evidence in Fukasawa and in Bacchi, we determine that, *prima facie*, one of ordinary skill in this art would have reasonably combined the teachings of Fukasawa and Bacchi, motivated by the range of movement of a convey arm required by Fukasawa for the apparatus disclosed therein as shown by arm 5 thereof, and the range of movement of arm 10 disclosed by Bacchi as explained above, in the reasonable expectation that the arm 10 of Bacchi can be mounted in the same position as shown for arm 5 in Fukasawa FIGs. 1, 2, 13a and 25, as argued by the examiner, and move wafers between the cassettes, the positioning mechanism and the vacuum processing chambers in convey paths including straight lines along the axes of translation straddling the drive section of arm 10, with the range of movement required of a convey arm by Fukasawa.

Accordingly, *prima facie*, one of ordinary skill in this art reasonably following the combined teachings of Fukasawa and Bacchi would have reasonably arrived at the claimed method encompassed by appealed claim 1, including all of the limitations thereof arranged as required by the claim, without recourse to appellant’s specification. *See In re Siebentritt*, 372 F.2d 566, 567-68, 152 USPQ 618, 619 (CCPA 1967) (express suggestion to interchange methods which achieve the same or similar results is not necessary to establish obviousness); *see also, e.g., Dow Chem.*, 837 F.2d at 473, 5 USPQ2d at 1531-32 (“The consistent criterion for determination of obviousness is whether the prior art would have suggested to one of ordinary skill in the art that [the claimed process] should be carried out and would have a reasonable likelihood of success, viewed in the light of the prior art. [Citations omitted] Both the suggestion and the expectation of success must be founded in the prior art, not in the applicant’s disclosure.”); *In re Keller*, 642 F.2d 413, 425, 208 USPQ 871, 881-82 (CCPA 1981) (“The test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art.”).

With respect to appealed claim 26, dependent on appealed claim 1, appellant points to the claim limitation which requires that “the substrate processing apparatus comprises at least three of the substrate holding areas located side by side to each other,” and points out that in Fukasawa **FIG. 2** there are “two side by side chambers (3a, 3b on one side and 4a, 4b of the other side)” and “[t]here is no disclosure or suggestion . . . of three substrate housing areas located side by side” (brief, pages 14-15). Appellant further contends that “[i]n Fig. 6A, Bacchi discloses transporting substrates to two (not three) chambers 168l, 168r with the arm staying in place,” and does not “disclose or suggest three side by side chambers” (*id.*, page 15). On this basis, appellant argues that the combination of references does not disclose the elements of claim 26.

The examiner responds that “4a, 4b and 4c in Fukasawa are side by side, as are 4b, 4c and 3b, as are 4c, 3b and 3a,” noting that claim 26 “does not require the stations be in a straight line” (answer, page 6).

We find that the claim limitation of appealed claim 26 that we quoted above must be interpreted in light of the language of claim 26 as a whole as well as the limitations of appealed claim 1, from which it is apparent that the pertinent language of claim 26 is “at least three of the substrate holding areas located side by side” and “the transport arm transporting substrates into and out of each of the three substrate holding areas,” and the pertinent limitation of claim 1 requires that “the substrate is moved along one of a number of generally parallel axes of translation straddling the drive section.” The axes of translation of all three holding areas in each of the examiner’s groups of three from Fukasawa **FIG. 2**, are *not* generally parallel because in each group, the axis of translation of at least one holding area is perpendicular to the axes of translation of the other two holding areas, and thus this embodiment of Fukasawa does not satisfy this limitation of claim 26.

However, we find that Fukasawa does not limit the number of vacuum processing chambers and the number of cassettes placed around the convey chamber to the number of such holding areas shown in Fukasawa **FIGs. 1, 2, 13a and 25**, disclosing instead a “plurality” of such substrate holding areas (e.g., cols. 2-3, 5-6, 17 and 19-20). Indeed, Fukasawa would have disclosed to one of ordinary skill in the art that because of the degree of freedom of the shape of the apparatus, “square convey chamber 2” can have “a plurality of vacuum process chambers and

cassette chambers . . . arranged around the convey chamber 2” (col. 10, lines 47-56). As we found above, the range of movement of arm 10 of Bacchi is not limited to the two axes of translation shown in Bacchi FIG. 6A, and thus this figure does not limit the number of substrate holding areas which arm 10 can reach.

Thus, based on the substantial evidence in the combined teachings of Fukasawa and Bacchi, we determine that, *prima facie*, one of ordinary skill in this art would have found in the combined teachings the reasonable suggestion to increase the number of vacuum processing chambers and/or the number of cassettes placed around the convey chamber 2 such that the axes of translation of a substrate into and out of these substrates holding areas are generally parallel, in the reasonable expectation that the arm 10 of Bacchi can move the substrate along the axes of translation into and out of the plurality of holding areas. We determine that one of ordinary skill in this art following the teachings of Fukasawa would have reasonably included an additional vacuum processing chamber 4_{alpha} and an additional cassette 3_{alpha} on the opposite sides of the convey chamber 2 in the apparatus shown in Fukasawa FIG. 2, for a total of three holding areas located side by side, and would have been motivated by the freedom of movement and the positioning of arm 5 in Fukasawa FIG. 2 and the instruction in Bacchi with respect to Bacchi FIG. 6A that arm 10 can radially translate a substrate along an axis of translation, to position the arm in one location relative to the three holding areas in the reasonable expectation that a substrate can be moved along the axis of translation of each holding area which are generally parallel to each other.

Accordingly, *prima facie*, one of ordinary skill in this art reasonably following the combined teachings of Fukasawa and Bacchi would have reasonably arrived at the claimed method encompassed by claim 26, including all of the limitations thereof arranged as required by the claim, without recourse to appellant’s specification. *See In re Harza*, 274 F.2d 669, 671, 124 USPQ 378, 380 (CCPA 1960) (“It is well settled that the mere duplication of parts has no patentable significance unless a new and unexpected result is produced, and we are of the opinion that such is not the case here.”); *see also Dow Chem.*, 837 F.2d at 473, 5 USPQ2d at 1531-32; *Keller*, 642 F.2d at 425, 208 USPQ at 881-82; *Siebentritt*, 372 F.2d at 567-68, 152 USPQ at 619.

With respect to appealed independent claim 29, appellant presents in the brief (pages 16-19) essentially the same arguments advanced with respect to the application of Fukasawa and Bacchi to appealed independent claim 1 (*see above* pp. 10-11; *see* brief, pages 7-13). Similarly, the examiner presents essentially the same arguments as well (*see above* pp. 10-11; *see* answer, pages 5-6).

Indeed, while we find some additional limitations in appealed claim 29 not present in appealed independent claim 1, we find that the additional limitations have not been specifically argued by appellant. Thus, we determine that, *prima facie*, the combined teachings of Fukasawa and Bacchi apply to claim 29 for the same reasons that these teachings apply to claim 1 as we stated above (*see pp.* 13-14). Accordingly, *prima facie*, one of ordinary skill in this art reasonably following the combined teachings of Fukasawa and Bacchi would have reasonably arrived at the claimed method encompassed by claim 29, including all of the limitations thereof arranged as required by the claim, without recourse to appellant's specification.

Therefore, since a *prima facie* case of obviousness has been established over the combined teachings of Fukasawa and Bacchi with respect to each of appealed claims 1, 26 and 29, we have again evaluated all of the evidence of obviousness and nonobviousness based on the record as a whole, giving due consideration to the weight of appellant's arguments in the brief and reply brief. *See generally, Oetiker*, 977 F.2d at 1445, 24 USPQ2d at 1444; *In re Piasecki*, 745 F.2d 1468, 1472, 223 USPQ 785, 788 (Fed. Cir. 1984).

Upon reconsideration of appellant's arguments, we remain convinced that one of ordinary skill in this art would have found in the combined teachings of the references the motivation to use arm 10 of Bacchi as the arm 5 in the apparatus of Fukasawa. Indeed, we cannot find any limitation in Bacchi FIG. 6A with respect to the range of movement of arm 10 in moving a substrate along the axes of translation of cassettes or other holding areas that straddle the drive section of arm 10 at the axis of rotation at the shoulder thereof. We particularly note in this respect, that appellant does not dispute that the range of movement of arm 10 in translating wafer 170, along axis of translation X_0 of cassette 168, that is, radially to the drive section of the arm, involves the same steps using the same movements as the arm in appealed independent claims 1 and 29. In view of the range of movement of arm 10 of Bacchi and the range of movement of

arm 5 required by Fukasawa, we remain of the opinion that one of ordinary skill in this art would have been motivated to use the arm of Bacchi as the arm in the apparatus of Fukasawa in the reasonable expectation that the arm of Bacchi could be mounted in the same manner as the arm in Fukasawa and convey the wafers as required by Fukasawa. We again find that the limitations in appealed claims 26 and 29 do not distinguish these claimed methods over the teachings of the combination of references.

Accordingly, based on our consideration of the totality of the record before us, we have weighed the evidence of obviousness found in the combined teachings of Fukasawa and Bacchi with appellant's countervailing evidence of and argument for nonobviousness and conclude that the claimed invention encompassed by appealed claims 1 through 4, 26 and 29 would have been obvious as a matter of law under 35 U.S.C. § 103(a).

In the two grounds of rejection of appealed claim 8 under § 103(a) over the combined teachings of Bacchi and Ohta, the examiner finds that "Bacchi discloses the claimed arm" and that "Ohta discloses arranging cassettes side by side in an arc," and on this basis, concludes that the combination of references establishes that (1) "[i]t would have been obvious to provide a plurality of side by side stations as claimed in Bacchi," and (2) "[i]t would have been an obvious substitution of equivalents to substitute an arm as claimed for the transfer in Ohta" (answer, pages 4-5).

Appellant points out that appealed claim 8 requires that "the robot transport arm is adapted to transport substrates into and out of three general side by side orientated substrate holding areas with the drive section being located in only one location relative to the three holding areas, and wherein the three side by side substrate holding areas are generally aligned with each other and disposed along one side of the drive section." Appellant submits that the references do not disclose or suggest the claimed method because Bacchi **FIG. 6A** shows only two substrate holding areas in combination with a mechanical arm 10, and that Ohta discloses a circular array of substrate holding areas in which "[a] pallet loading/unloading device 30 is provided in the center of the circular array" and none of the holding areas is located side by side aligned along one side of the drive section (brief, pages 20-22). The examiner responds that Ohta "figure 1 aligns the three most rightwardly placed stations side by side in an arc on the right

side of the transfer 63” (answer, page 6). In the reply brief, appellant argues that the examiner has not set forth any motivation or suggestion in the references which would have led one of ordinary skill in the art to combine the same (pages 2-3).

We agree with appellant. We find that Ohta discloses a pallet changing system for a machine tool which utilizes a pallet changing device for exchanging pallets between stations, and that Bacchi discloses a multi-linked robot mechanical arm for moving wafers between substrate holding areas. The examiner provides no explanation why one of ordinary skill in the art would have considered combining systems that move disparate workpieces in disparate manner, for purposes of modifying either system. It is well settled that the examiner must point to some teaching, suggestion or motivation in the prior art to support the combination of references, and because on this record the examiner has failed to do so, no *prima facie* case of obviousness has been made out with respect to appealed claim 8. *See Lee, supra; Smiths Indus. Medical Sys., Inc. v. Vital Signs, Inc.*, 183 F.3d 1347, 1356, 51 USPQ2d 1415, 1420-21 (Fed. Cir. 1999); *In re Mayne*, 104 F.3d 1339, 1342, 41 USPQ2d 1451, 1454 (Fed. Cir. 1997); *Fritch*, 972 F.2d at 1266, 23 USPQ2d at 1783; *ACS Hosp. Sys., Inc. v. Montefiore Hosp.*, 732 F.2d 1572, 1577, 221 USPQ 9292, 933 (Fed. Cir. 1984); *Keller*, 642 F.2d at 425-26, 208 USPQ at 881-82.

Accordingly, we reverse the ground of rejection of appealed claims 8 through 16 under § 103(a).

Finally, we arrive at appealed claim 28 which is included in the same ground of rejection as appealed claims 8 through 16 in the answer (Paper No. 18) without explanation for doing so even in view of the differences in claim limitations between this claim and claims 8 through 16.

The record shows that this same ground of rejection of claim 28 was stated without explanation in the final rejection mailed June 20, 2001 (Paper No. 13). However, after appellant responded to this ground of rejection of claim 28 in the brief (Paper No. 15), the examiner then included claim 28 with the ground of rejection of appealed claims 1 through 4, 26 and 29 over a different combination of references without explanation, in the final rejection mailed April 5, 2002 (Paper No. 16). Appellant then filed the supplemental brief on August 14, 2002 (Paper No. 17) for the express purpose of responding only to the rejection of claim 28 as it appeared in that final rejection. The examiner changed the ground of rejection of claim 28 again in the answer.

In the reply brief filed February 19, 2003 (Paper No. 19), appellant notes the examiner's changing positions without explanation with respect to claim 28, stating that "it is no longer clear to the Appellant the exact basis for the rejection of claim 28" (page 3). In the Office letter mailed March 21, 2003 (Paper No. 20), the examiner entered the reply brief, stating that "the examiner's answer contained an inadvertent typographical error" in not including claim 28 in the ground of rejection applied to appealed claims 1 through 4, 26 and 29, and then stated a ground of rejection of claim 28 based on the combination of references applied to claims 1 through 4, 26 and 29.

In prior Appeal No. 2003-1588 in this application, we remanded the application to the examiner on December 19, 2003 (Paper No. 23) "to either withdraw said communication [mailed March 21, 2003 (Paper No. 20)] and issue a further communication that only acknowledges receipt and entry of the reply brief, or withdraw the final rejection and reopen prosecution, as required under § 1.193(b)(1)" (decision, page 2). We further noted in our decision that

the examiner has changed the examiner's answer mailed December 9, 2002 (Paper No. 18) in this respect by inserting "28" in one ground of rejection and deleting "28" from two other grounds of rejection, initialing and dating the change "03/20/03" with the notation "see paper # 20" (page 4). The examiner's answer was not remailed. [Page 1.]

In the Office letter mailed April 8, 2004 (Paper No. 23), the examiner states that "[t]he communication mailed 03/21/03 is withdrawn as per the Board's letter mailed 12/19/03," and entered the reply brief.

Accordingly, the Office letter mailed March 21, 2003 (Paper No. 20) is not before us.

In view of the record with respect to the changing grounds of rejection of appealed claim 28, none of which is accompanied by any explanation of the ground of rejection with respect to the claimed invention encompassed by claim 28, and since the examiner has not responded to appellant's arguments with respect to two possible grounds in the brief and supplemental brief, respectively, or remailed the examiner's answer with the initialed and dated changes therein, we agree with appellant that the examiner's basis for rejecting claim 28 is not clear from the record. Therefore, since the examiner has not established a *prima facie* case of obviousness of the

claimed invention encompassed by claim 28 within the meaning of § 103(a), we reverse the rejection of this claim.

In summary, we have affirmed the ground of rejection of appealed claims 1 through 4, 26 and 29, and we have reversed the grounds of rejection of appealed claims 5, 8 through 16 and 28.

Other Issues

We decline to exercise our authority under 37 CFR § 1.196(b) (2003) and enter on the record new grounds of rejection of appealed claims 5, 8 through 16 and 28, allowed claims 6, 7 and 19 through 23, and claims 17, 18, 24, 25 and 27 which have been allowed in substance, under 35 U.S.C. § 103(a) based on the combined teachings of Fukasawa and Bacchi as applied to appealed claims 1 through 4, 26 and 29 above, leaving it to the examiner to apply this combination of references along with any other applicable prior art developed by the examiner, to these claims.

The examiner's decision is affirmed-in-part.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 CFR § 1.136(a).

AFFIRMED-IN-PART

Edward (Kurt)

EDWARD C. KIMLIN
Administrative Patent Judge

[Signature]

CHARLES F. WARREN
Administrative Patent Judge

Beverly A. Cawthron

BEVERLY A. PAWLIKOWSKI
Administrative Patent Judge

BOARD OF PATENT APPEALS AND INTERFERENCES

Appeal No. 2004-1398
Application 09/163,844

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